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Published in:
Book of Abstracts

Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

SELECTING THE COST EFFECTIVE TREATMENT OPTION FOR PRIORITIZED PHARMACEUTICALS

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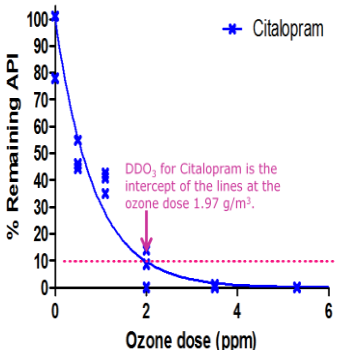
EXECUTIVE SUMMARY

The presence of active pharmaceutical ingredients (APIs) in municipal wastewater treatment plants (WWTPs) is considered to be the main source of contamination of water resources. The potential side effects that APIs can cause to wild life and humans from chronic exposure, necessitates their efficient removal from wastewater effluents prior discharge. The emerging solution to this problem for the environment is to implement an advanced targeted treatment for micropollutants at WWTPs. The most promising solutions in terms of effectiveness and economy are oxidation method, particularly ozone and chlor dioxide, and use of sorbents, particularly powder activated carbon. Each treatment has different effectiveness for each API so it is not directly possible to select one optimal method for all APIs and therefore in practice the choice of method will depend on the list of prioritised chemicals which it is required to remove.

In our comparison procedure we first consider the removal of each APIs by biodegradation that can be expected based on the treatment insensitivity and removal by sorption to sludge.



Our concept of comparing the effect of different advanced treatments is to model, based on experimental data from laboratory scale studies, the treatment dose which removed 90 % of the concentration of each API. We have named this parameter: Decadic removal Dose, DD. Since most of the applied treatment chemical or sorbent is wasted on the bulk organic carbon in the wastewater and only a small fraction actually reacts with API, this concept is almost independent of the API concentration.

	API	Decadic Dose of PAC		Cost: 25 kr/kg	
Powder Activated Carbon	Diclofenac	3.5 g/m^3		0.088 kr/m^3	
	Ethinylestradiol	1 g/m^3		0.025 kr/m^3	
	Ibuprofen	<50 mg/m^3		<0.001 kr/m^3	
Chlorine dioxide	API	Decadic Dose of ClO_2 (g/m^3)		Cost:	50 kr/kg
		Low COD	High COD	Low COD	High COD
	Diclofenac	1	2.5	0.05 kr/m^3	0.13 kr/m^3
	Ethinylestradiol	1	2.5	0.05 kr/m^3	0.13 kr/m^3
	Ibuprofen	>20	>20	>1.0 kr/m^3	>1.0 kr/m^3
Ozone	API	Decadic Dose of O_3 (g/m^3)		Cost:	20 kr/kg
		Low COD	High COD	Low COD	High COD
	Diclofenac	4.5	11	0.09 kr/m^3	0.22 kr/m^3
	Ethinylestradiol	2	5	0.04 kr/m^3	0.10 kr/m^3
	Ibuprofen	9	10	0.18 kr/m^3	0.20 kr/m^3

In the Mistrapharma project decadic doses (g/m^3 per 1.st order of API removal) were determined for 50-75 commonly occurring APIs in wastewater effluents for alternative polishing methods.

Depending on the biological treatment and the APIs selected to be critical, each type of the additional treatments considered can be the best choice.